FIG. 1A

TRANSMISSION TO SWITCH			RECEIPT FROM SWITCH		
STATE	A	B	STATE	A	B
On-Hook	0	0	Channnel Test	0	1
Off-Hook	1	0	Forward Disc.	1	0
Unequipped	1	1	Idle	1	1
UNDEFINED	0	1	-R Ringing	1	1/0

*1/0 REPRESENTS THAT "1"A DN "0" ARE INTERCHANGEABLE (IF "1" AT PRESENT, "0" COMES AT NEXT CYCLE)

FIG. 1B

TRANSMISSION TO SWITCH					RECEIPT FROM SWITCH				
STATE	A	B	C	D	STATE	A	B	C	D
	0	0	0	0	-R Ringing	0	0	0	0
	0	0	0	1		0	0	0	1
DSO AIS	0	0	1	0	DSO AIS	0	0	1	0
	0	0	1	1		0	0	1	1
	0	1	0	0	RLCF	0	1	0	0
LO	0	1	0	1	LCF	0	1	0	1
	0	1	1	0		0	1	1	0
DSO RAI	0	1	1	1	DSO RAI	0	1	1	1
Reserverd	1	0	0	0	Reserverd	1	0	0	0
	1	0	0	1		1	0	0	1
	1	0	1	0		1	0	1	0
	1	0	1	1		1	0	1	1
	1	1	0	0		1	1	0	0
Reserverd	1	1	0	1	Reserverd	1	1	0	1
	1	1	1	0		1	1	1	0
LC	1	1	1	1	LCFO	1	1	1	1

*BLANK INDICATES "UNDEFINED"

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FIG. 2

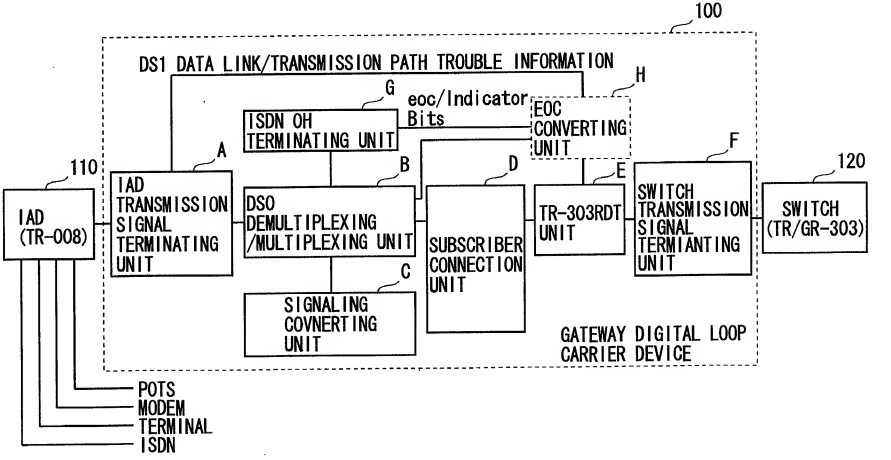

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FIG. 3A

(1) CONVERSION FROM ABCD PATTERN INTO AB PATTERN
(SWITCH → INTEGRATED ACCESS DEVICE)

SIGNALING FROM SWITCH				SIGNALING TYPE (1/2)																					
				Signale Party(POTS)					UVG-LS, UVG-GS					COIN-DTF, COIN-CF					AN12					DID-DPT				
A	B	C	D	*1	A	B	A'	B'	*1	A	B	A'	B'	*1	A	B	A'	B'	*1	A	B	A'	B'	*1	A	B	A'	B'
0	0	0	0	1	1	1/0	1	0/1	1	1	1/0	1	0/1	1	1	1/0	1	0/1	1	1	1/0	1	0/1	0	*		*	
0	0	0	1	0		*		*	0		*		*	0		*		*	0		*		*	0	*		*	
0	0	1	0	1	1	1	1	1	1	0	1/0	0	0/1	1	0	0	0	0	1	1	1	1	1	0	*		*	
0	0	1	1	0		*		*	0		*		*	0		*		*	0		*		*	0	*		*	
0	1	0	0	1	1	1	1	1	1	0	1/0	0	0/1	1	1	0	1	0	0		*		*	0	*		*	
0	1	0	1	1	1	1	1	1	1	0	1/0	0	0/1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
0	1	1	0	0		*		*	0		*		*	0		*		*	0		*		*	0	*		*	
0	1	1	1	0		*		*	0		*		*	0		*		*	0		*		*	0	*		*	
1	0	0	0	0		*		*	0		*		*	0		*		*	0		*		*	0	*		*	
1	0	0	1	0		*		*	0		*		*	0		*		*	0		*		*	0	*		*	
1	0	1	0	0		*		*	0		*		*	1	0	1/0	0	0/1	1	1/0	1/0	0/1	0/1	0	*		*	
1	0	1	1	0		*		*	0		*		*	1	1/0	1/0	0/1	0/1	1	1	0	1	0	0	*		*	
1	1	0	0	0		*		*	0		*		*	1	1/0	0	0/1	0	1	1/0	0	0/1	0	0	*		*	
1	1	0	1	0		*		*	0		*		*	0		*		*	0		*		*	0	*		*	
1	1	1	0	0		*		*	0		*		*	1	1/0	1	0/1	1	1	1/0	1	0/1	1	0	*		*	
1	1	1	1	1	1	0	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

(*1) 1:ABCD→AB CONVERSION IS EFFECTIVE, 0: CONVERSION IS INEFFECTIVE, AND SIGNALING ONE CYCLE BEFORE IS TRANSMITTED.
* UNDEFIND IN TR-303 OR RESERVED, AND AB SIGNALING ONE CYCLE BEFORE IS TRANSMITTED. 1/0 AND 0/1 EACH INDICATES THE "1" AND "0" ARE INTERCHANGEABLE AND IMPLIES THAT IF, E.G., A BIT IS 0, A' BIT BECOMES 1.

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FIG. 3B

(1) CONVERSION FROM ABCD PATTERN INTO AB PATTERN
(SWITCH → INTEGRATED ACCESS DEVICE)

SIGNALING FROM SWITCH				SIGNALING TYPE (2/2)																							
				DID-DPO					FXO-LS					FXO-GS, TDM-FXS					FXS-LS, TDM-FXO					DX, E&M, PLR, TDM-E&M				
A	B	C	D	*1	A	B	A'	B'	*1	A	B	A'	B'	*1	A	B	A'	B'	*1	A	B	A'	B'	*1	A	B	A'	B'
0	0	0	0	0	*		*		1	0	1	0	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0
0	0	0	1	0	*		*		0	*		*		0	*		*		1	0	0	0	0	0	*		*	
0	0	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1
0	0	1	1	0	*		*		0	*		*		0	*		*		0	*		*		0	*		*	
0	1	0	0	1	1	1	1	1	0	*		*		0	*		*		1	0	1	0	1	0	*		*	
0	1	0	1	1	0	0	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	*		*	
0	1	1	0	0	*		*		0	*		*		0	*		*		0	*		*		0	*		*	
0	1	1	1	0	*		*		0	*		*		0	*		*		0	*		*		0	*		*	
1	0	0	0	0	*		*		0	*		*		0	*		*		0	*		*		0	*		*	
1	0	0	1	0	*		*		0	*		*		0	*		*		0	*		*		0	*		*	
1	0	1	0	0	*		*		0	*		*		0	*		*		0	*		*		0	*		*	
1	0	1	1	0	*		*		0	*		*		0	*		*		0	*		*		0	*		*	
1	1	0	0	0	*		*		0	*		*		0	*		*		0	*		*		0	*		*	
1	1	0	1	0	*		*		0	*		*		0	*		*		0	*		*		0	*		*	
1	1	1	0	0	*		*		0	*		*		0	*		*		0	*		*		0	*		*	
1	1	1	1	0	*		*		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

(*1) 1: ABCD→AB CONVERSION IS EFFECTIVE, 0: CONVERSION IS INEFFECTIVE, AND SIGNALING ONE CYCLE BEFORE IS TRANSMITTED.
* UNDEFIND IN TR-303 OR RESERVED, AND AB SIGNALING ONE CYCLE BEFORE IS TRANSMITTED. 1/0 AND 0/1 EACH INDICATES THE "1" AND "0" ARE INTERCHANGEABLE AND IMPLIES THAT IF, E.G., A BIT IS 0, A' BIT BECOMES 1.

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FIG. 4A

(2) CONVERSION FROM AB PATTERN INTO ABCD PATTERN (INTEGRATED ACCESS DEVICE → SWITCH), 1··· SIGNALING TO SWITCH, 2··· SIGNALING CATEGORY

SIGNALING TO SWITCH				SIGNALING TYPE (1/2)																							
				Signale Party(POTS)						UVG-LS, UVG-GS						COIN-DTF, COIN-CF, AN12						DID-DPT					
A	B	A'	B'	*1	A	B	C	D	*2	*1	A	B	C	D	*2	*1	A	B	C	D	*2	*1	A	B	C	D	*2
0	0	0	0	1	0	1	0	1	1	1	0	1	0	1	1	1	0	1	0	1	1	1	0	1	0	1	1
0	1	0	1	0			*		1	1	0	0	0	0	0	1	1	1	1	0	0	0		*			1
1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	0		*			1
1	1	1	1	1	0	0	1	0	1	1	0	0	1	0	1	1	0	0	1	0	1	1	0	1	0	0	0
0	1/0	0	0/1	0			*		1	0			*		1	0			*		1	0			*		1
1	1/0	1	0/1	0			*		1	0			*		1	0			*		1	0			*		1
1/0	0	0/1	0	0			*		1	0			*		1	0			*		1	0			*		1
1/0	1	0/1	1	0			*		1	0			*		1	0			*		1	0			*		1
1/0	1/0	0/1	0/1	0			*		1	0			*		1	0			*		1	0			*		1

(*1) 1:AB → ABCD CONVERSION IS EFFECTIVE, 0: CONVERSION IS INEFFECTIVE, AND SIGNALING ONE CYCLE BEFORE IS TRANSMITTED.
(*2) 1: AFTER AB→ABCD CONVERSION, RECOGNITION IS THAT IT IS ON-HOOK STATE, 0: RECOGNISTION OF IT IS OFF-HOOK (CALLING) STATE.
* UNDEFINED IN TR-303 OR RESERVED, AND ABCD SIGNALING ONE CYCLE BEFORE IS TRANSMITTED.
1/0 AND 0/1 EACH INDICATES THE "1" AND "0" ARE INTERCHANGEABLE AND IMPLIES THAT IF, E.G., A BIT IS 0, A' BIT BECOMES 1.

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FIG. 4B

(2) CONVERSION FROM AB PATTERN INTO ABCD PATTERN (INTEGRATED ACCESS DEVICE → SWITCH), 1··· SIGNALING TO SWITCH, 2··· SIGNALING TYPE

SIGNALING TO SWITCH				SIGNALING TYPE (2/2)																							
				DID-DPO						FXO-LS, FXO-GS, FXS-GS, TDM-FXS, TDM-FXO						FXS-LS						DX, E&M, PLR, TDM-E&M					
A	B	A'	B'	*1	A	B	C	D	*2	*1	A	B	C	D	*2	*1	A	B	C	D	*2	*1	A	B	C	D	*2
0	0	0	0	1	0	1	0	1	1	1	0	0	0	0	0	0			*		1	1	0	0	0	0	1
0	1	0	1	0			*		1	1	0	1	0	1	1	1	0	1	0	1	1	0			*		1
1	0	1	0	0			*		1	0			*		1	0			*		1	0			*		1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
0	1/0	0	0/1	0			*		1	0			*		1	0			*		1	0			*		1
1	1/0	1	0/1	0			*		1	0			*		1	0			*		1	0			*		1
1/0	0	0/1	0	0			*		1	0			*		1	0			*		1	0			*		1
1/0	1	0/1	1	0			*		1	0			*		1	0			*		1	0			*		1
1/0	1/0	0/1	0/1	0			*		1	0			*		1	0			*		1	0			*		1

(*1) 1:AB → ABCD CONVERSION IS EFFECTIVE, 0: CONVERSION IS INEFFECTIVE, AND SIGNALING ONE CYCLE BEFORE IS TRANSMITTED.
(*2) 1: AFTER AB→ABCD CONVERSION, RECOGNITION IS THAT IT IS ON-HOOK STATE, 0: RECOGNISTION OF IT IS OFF-HOOK (CALLING) STATE.
* UNDEFINED IN TR-303 OR RESERVED, AND ABCD SIGNALING ONE CYCLE BEFORE IS TRANSMITTED.
1/0 AND 0/1 EACH INDICATES THE "1" AND "0" ARE INTERCHANGEABLE AND IMPLIES THAT IF, E.G., A BIT IS 0, A' BIT BECOMES 1.

FIG. 5

Service(ISDN FPT)	ISDN PROTOCOL CONVERTING PROCESS (OUTLINE)
M-CREATE	1. PAD DOWNSTREAM-DIRECTIONAL Indicator Bits' 1111111111'b TO MAKE U-POINT ACTIVE THAT IS CONNECTED TO INTEGRATED ACCESS DEVICE. 2. PAD Return To Normal OF ADDRESS 7 IN DOWNSTREAN DIRECTION eoc TO CANCEL CONTROL STATE OF U-POINT CONNECTED TO INTEGRATED ACCESS DEVICE. 3. SET Attribute IN INITIAL VALUE. 4. CLEAR PM REGISTER AND STARTS PM CALCULATION.
M-DELETE	1. PAD DOWNSTREAM-DIRECTIONAL Indicator Bits' 1111111111'b TO DEACTIVATE U-POINT CONNECTED TO INTEGRATED ACCESS DEVICE. 2. PAD Return To Normal OF ADDRESS 7 IN DOWNSTREAN DIRECTION eoc TO CANCEL CONTROL STATE OF U-POINT CONNECTED TO INTEGRATED ACCESS DEVICE.
SET	<CASE OF CHANGE IN SETTING OF itOHStates value>, PAD DESIGNATED itOHStates VALUE TO DOWNSTREAM-DIRECTIONAL Indicator Bits, <CASE OF CHANGE IN SETTING OF PM Threshold VALUE>, REWRITE DEVICE INTERNAL MANAGEMENT DATA INTO PM Threshold VALUE, <CASE OF INITIALIZING PM REGISTER VALUE TO 0>, 1. INITIALIZE DESIGNATED PM REGISTER TO 0. 2. SPECIFY ADDRESS 1 BY DATA WRITE PROTOCOL (WRITE DATA) WITH RESPECT TO CORRESPONDING PM DATA AND PADD IT IN DOWNSTREAM DIRECTION eoc.
M-GET	REPLY Attribute VALUE INTACT THAT IS MANAGED INSIDE DEVICE.
M-ACTION: operateIDSNLoopback	INSERT ONE OF Operate 2B+D Loopback, Operate B1 Loopback, Operate B2 Loopback MESSAGES IN DOWNSTREAM DIRECTION eoc THROUGH SPECIFIED CHANNEL BY SPECIFYING ADDRESS 1 (INTEGRATED ACCESS DEVICE), ADDRESS 0 (NT1) DEPENDIG ON SPECIFIED LOCATION.
M-ACTION: releaseIDSNLoopback	INSERT Return To Normal MESSAGE IN DOWNSTREAM DIRECITON eoc BY SPECIFYING ADDRESS 1(LULT), ADDRESS 0(NT1) DEPENDING ON SPECIFIED LOCATION.

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FIG. 6A

Service(ISDN FPT)	ISDN PROTOCOL CONVERTING PROCESS (OUTLINE)
M-ACTION: generateCorruptedcrc	<SPECIFIED LOCATION IS INTEGRATED ACCESS DEVICE> 1. INSERT Notify of Corrupted crc MESSAGE WITH ADDRESS 0 IN DOWNSTREAM DIRECTION eoc. 2. INSERT Request Corrupted crc MESSAGE WITH ADDRESS 1 IN DOWNSTREAM DIRECTION eoc. 3. START UP TIMER FOR SPECIFIED TIME. 4. INSERT Return To Normal MESSAGE WITH ADDRESS 1 IN DOWNSTREAM DIRECTION eoc JUST WHEN TIMER COMES TO TIME-OUT. <SPECIFIED LOCATION IS NT1> 1. INSERT Notify of Corrupted crc MESSAGE WITH ADDRESS 1 IN DOWNSTREAM DIRECTION eoc. 2. INSERT Request Corrupted crc MESSAGE WITH ADDRESS 0 IN DOWNSTREAM DIRECTION eoc. 3 AND 4 ARE THE SAME AS ABOVE.
M-ACTION: initializePMAttributes	<CASE OF SPECIFYING ALL PM Attributes>, 1. INITIALIZE ALL PM REGISTERS TO 0. 2. INSERT Reset PM Registers to Zero MESSAGE WITH ADDRESS IN DOWNSTREAM DIRECTION eoc. <CASE OF SPECIFYING Current AM Attribute> 1. INIJTIALIZE PM REGISTER(Current) TO 0. 2. EXECUTE Data Write Protocol (Write Data) WITH ADDRESS 1 IN DOWNSTREAM DIRECTION eoc PER PM DATA (Current).

* M-ACTION AND M-SET ARE EFFECITIVE IN ONLY Confirmed MODE.

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FIG. 6B

Service(ISDN FPT)	ISDN PROTOCOL CONVERTING PROCESS (OUTLINE)
M-ACTION:remove	SET PrimaryServiceState = oos, secondaryServiceState = mt, swtch
M-ACTION:restore	SET PrimaryServiceState = is, secondaryServiceState = empty
M-ACTION: TransmiteocOpcodeToNT1	INSERT SPECIFIED Opcode WITH ADDRESS 0 IN DOWNSTREAM DIRECTIN eoc
M-EVENT-REPORT: eventReporting	TRANSMIT WHEN DETECTING CHANGE OF PrimaryServiceState.
M-EVENT-REPORT: changeOfOverheadBit	TRANSMIT WHEN DETECTING CHANGE OF ntOHStates.
M-EVENT-REPORT: lossOfSignal	PERIODICALLY MONITOR UPSTREAM DIRECTION eoc, AND TRANSMIT WHEN DETECTING Loss or Synchronization Word MESSAGE.
M-EVENT-REPORT: eventReporting(TCA)	COMPARE PM REGISTER (Current) VALUE WITH Threshold VALUE, AND TRANSMIT WHEN REGISTER VALUE BECOMES OVER Threshold VALUE.

* M-ACTION AND M-SET ARE EFFECITIVE IN ONLY Confirmed MODE.

FIG. 7

Attribute(ISDN FPT)	ISDN PROTOCOL CONVERTING PROCESS (OUTLINE)
primaryServiceState	1. is/empty IS SET AT M-CREATE. 2. oos/mt, fef IS SET JUST WHEN DETECTING Loss of Superframe Marker, AND is/empty IS SET WHEN RECOVERED. 3. oos/mt, mon IS SET JUST WHEN RECEIVING Loss of Synchronization Word MESSAGE IN TRANSMISSION eoc. 4. oos/mt, lpbk ARE SET AT Loopback BOOTING, AND is/empty IS SET AT CANCELATION. 5. Oos/mt, swtch ARE SET AT Remove, AND is/empty IS SET AT Restore.
secondaryServiceState	
ltOHStates	SET '111111111111'b (INITIAL VALUE) AT M-CREATE. 2. PAD THIS VALUE TO DOWNSTREAM-DIRECTIONAL Indicator Bits JUST WHEN VALUE CHANGES. 3 SET '111111111111'b AT M-DELETE.
ntOHStates	SET UPSTREAM-DIRECTIONAL Indicator Bits VALUE JUST WHEN THIS VALUE CHANGES.
channnelSelection	SET '111'b (INITIAL VALUE) AT M-CREATE. 2. SET BIT CORRESPONDING TO SPECIFIED CHANNEL TO 0 JUST WHEN SUCEEDING IN M-ACTION:operateISDNLoopback EXECUTION. 3. SET BIT CORRESPONDING TO SPECIFIED CHANNEL TO 1 JUST WHEN SUCEEDING IN M-ACTION:releaseISDNLoopback EXECUTION. 4. SET '111'b IF THERE OCCURS EVENT THAT PrimaryServiceState CHANGES TO oos DURING M-ACTION:operateISDNLoopback EXECUTION.
esHrThreshold	1. MANAGE SPECIFIED VALUE IN M-CREATE WITHIN DEVICE. 2. MANAGE SPECIFIED VALUE IN M-SET WITHIN DEVICE. * Threshold Crossing CAN BE DETECTED BY COMPARISON WITH UPSTEAM-DIRECTIONAL PM REGISTER (Current), AND HENCE NO SETTING IS DONE FOR INTEGRATED ACCESS DEVICE BY USING Data Write Protocol (Set PM Threshold)
sesHrThreshold	
esDayThreshold	
sesDayThreshold	

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FIG. 8

Attribute(ISDN FPT)	ISDN PROTOCOL CONVERTING PROCESS (OUTLINE)
cvHrCurrent esHrCurrent sesHrCurrent esDayCurrent sesDayCurrent cvFeHrCurrent esFeHrCurrent sesFeHrCurrent esFeDayCurrent sesFeDayCurrent	AFTER M-CREATE, SPECIFY ADDRESS 1 BY Data Read Protocol (Retrieve data) PER Attribute AT CYLCLE SHORTER THAN ONE HOUR, INSERT IT IN DOWNSTREAM DIRECTON eoc, AND SET RESULT IN CORRESPONDING PM REGISTER (Current). MAPPINGS ARE AS FOLLOWS
cvHrPrevious esHrPrevious sesHrPrevious esDayPrevious sesDayPrevious cvFeHrPrevious esFeHrPrevious sesFeHrPrevious esFeDayPrevious sesFeDayPrevious	SHIFT PM REGISTER (Current) to PM REGISTER (Previous) AT INTERVAL OF 1 HOUR OR 24 HOURS.
esHrHistory esFeHrHistory	PM REGISTER (History) IS 7-TIERED, FASTEST IS History#2, AND OLDEST IS History#8. SHIFT PM REGISTER (Previous) to (History#2) AND PM REGISTER (History#n-1) to (History#n) AT INTERVAL OF ONE HOUR.

*[RECEIPT] INDICATES (DOWNSTREAM) DIRECTION OF RECEIVING FROM SWITCH, AND [TRANSMISSION] INDICATES (UPSTEAM) DIRECTION OF TRANSMITTING TO SWITCH

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FIG. 9

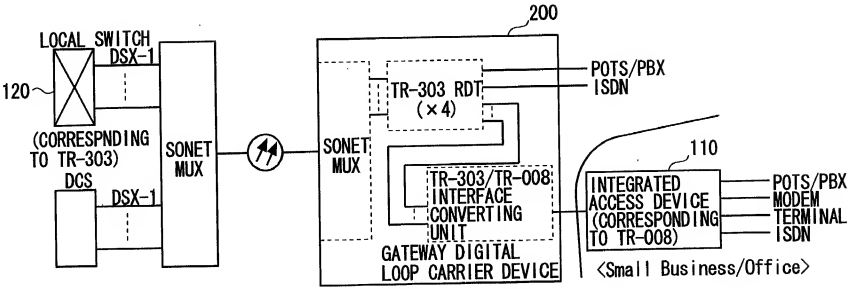
200
LOCAL SWITCH
DSX-1
120
(CORRESPNDING TO TR-303)
DCS
DSX-1
SONET MUX
SONET MUX
TR-303 RDT (×4)
POTS/PBX
ISDN
TR-303/TR-008 INTERFACE CONVERTING UNIT
GATEWAY DIGITAL LOOP CARRIER DEVICE
110
INTEGRATED ACCESS DEVICE (CORRESPONDING TO TR-008)
POTS/PBX
MODEM
TERMINAL
ISDN
<Small Business/Office>

FIG. 10

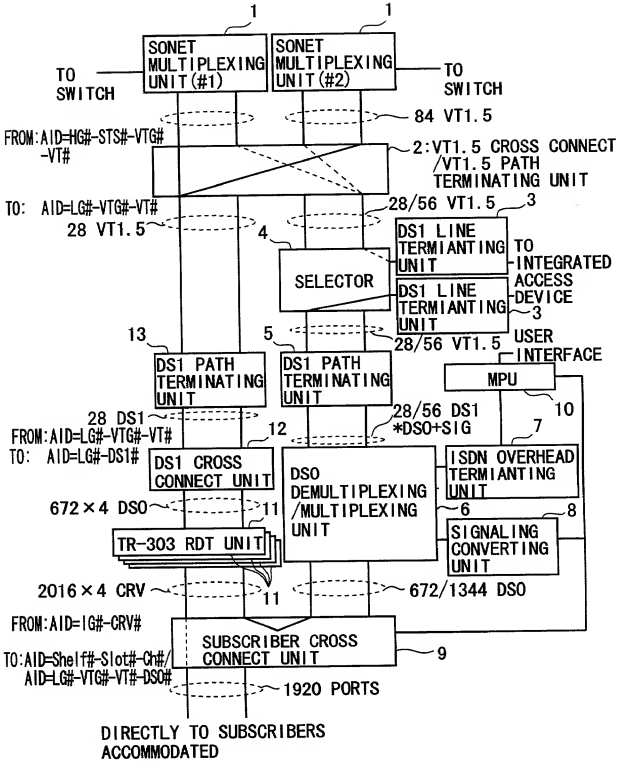

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FIG. 11A PARIOR ART

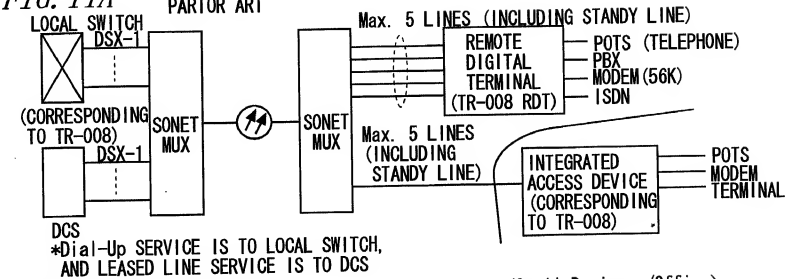
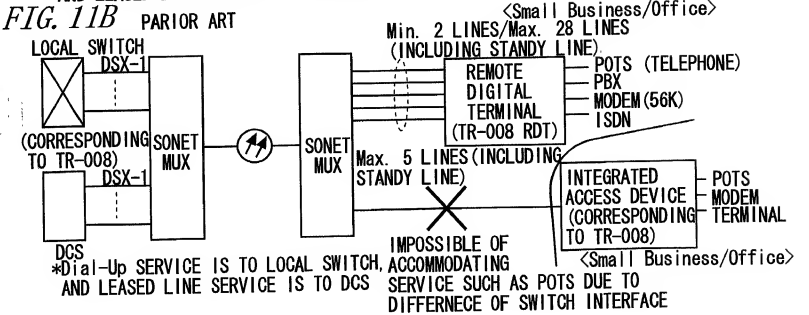
FIG. 11B PARIOR ART